THE EPIC SYSTEM
COMPLETE REFERENCE

ENVIRONMENTAL · PASSIVE · INTEGRATED · CONVEYANCE

EPIC Explained

How the EPIC subsurface water-management system is built, how it works in the ground, and why it performs as a long-term, circular water solution.

4 parts · 34 questions · complete technical reference
The System of Choice · Components · How It Works · Cradle to Cradle

EDITION 3 · 2026

One sealed basin below ground – irrigation, drainage, storage and filtration in a single passive system.

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ABOUT THIS GUIDE

EPIC, explained end to end

This is the single authoritative reference for the EPIC — **E**nvironmental **P**assive **I**ntegrated **C**onveyance — subsurface water-management system: what it is, what it is made of, how it is built, how it behaves in the ground, and what happens to it at the end of its life.

It consolidates the EPIC source record — the system overview, the component specifications, the installation and operation sequence, and the Cradle-to-Cradle sustainability analysis — into one navigable volume. Duplication has been removed, the strongest description of each topic retained, and the design rules, fixed specification values and operating protocol added so that the document answers a specifier as well as it answers a client.

It is written for developers, consulting and irrigation engineers, landscape architects, contractors, and sustainability and procurement teams. Every part is written to be read on its own; every question in the Contents is a live link to its answer.



An EPIC chamber laid on the gravel bed over the EPDM liner — the heart of the system that stores and conveys water below grade.

HOW TO USE IT

Part I introduces the system and its advantages. **Part II** details the physical components and their specifications. **Part III** covers the physics, the layer stack, the design rules, installation and operation. **Part IV** covers sustainability, materials science, applications and return.

THREE WORDS, USED PRECISELY

EPIC CHAMBER

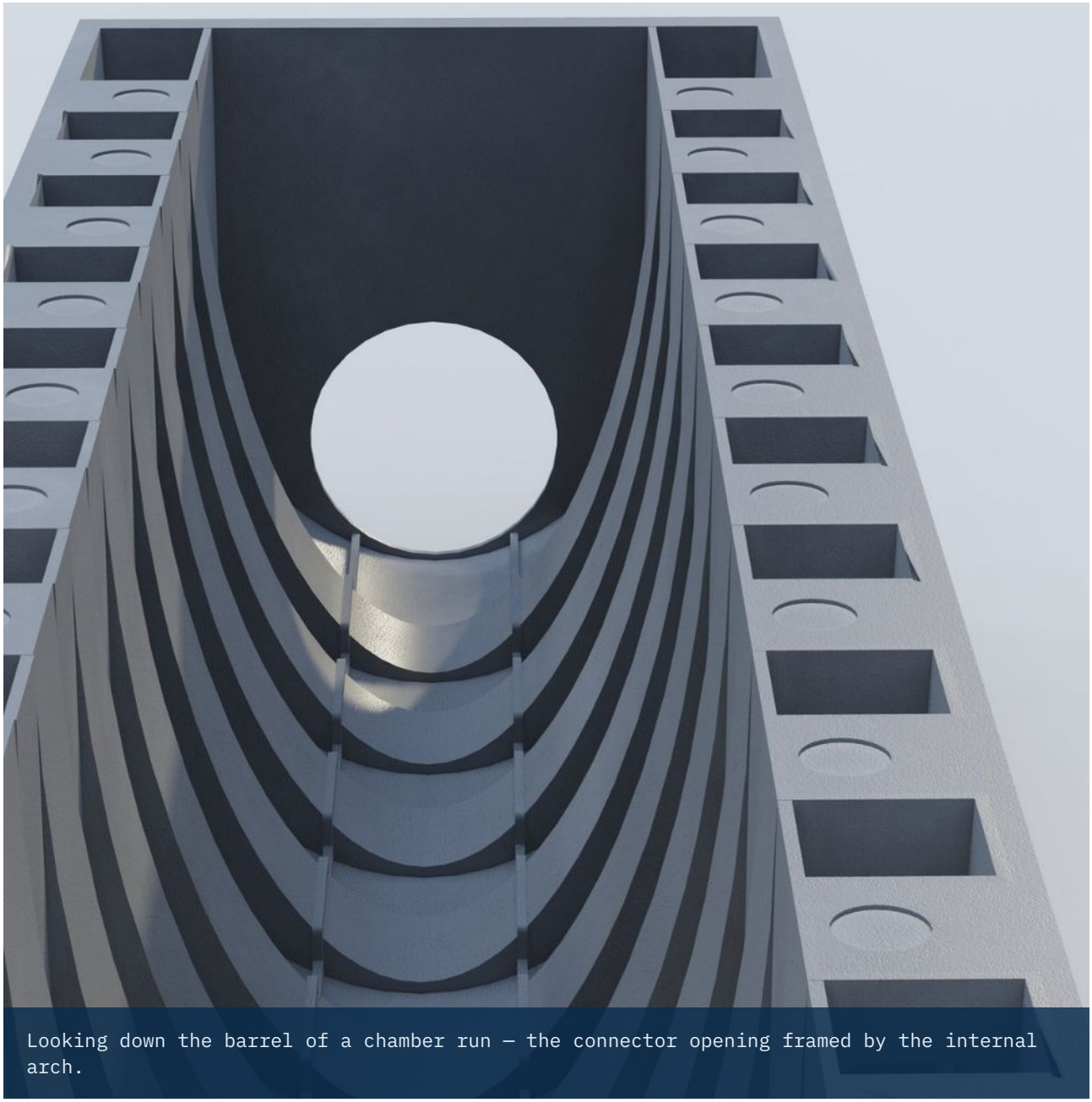
The moulded polypropylene arch — the patented core component that stores water and transfers it into the profile.

EPIC CELL

One lined basin: EPDM liner, the chambers and pipework inside it, the gravel and the sand above them. The unit of design.

EPIC PROFILE

The whole assembly from subgrade to vegetated surface — cell, growing medium and planting working as one system.



Looking down the barrel of a chamber run — the connector opening framed by the internal arch.

Contents

Every part and question below is a live link — tap any entry to jump to its answer.

I The System of Choice

1.1 What is the EPIC Water Management System? 9

1.2 Why is EPIC the system of choice for sand-culture hydroponics? 9

1.3 What water-management functions does EPIC provide automatically? 10

1.4 Why is EPIC environmentally friendly? 10

1.5 Why is EPIC simple? 10

1.6 How does EPIC save water? 11

1.7 Does EPIC have low operational and maintenance costs? 12

1.8 What are the direct and indirect impacts of EPIC? 13

1.9 What water can EPIC run on? 14

II System Components Explained

2.1 How many types of EPIC chamber are there, and what are the patents? 16

2.2 What two families of components make up the system? 16

2.3 What is the EPIC Chamber? 17

2.4 What liner is used? 18

2.5 What role does the gravel play? 18

2.6 What role does the sand play? 19

2.7 What else is inside an EPIC Cell? 19

2.8 Chamber specifications at a glance 20

2.9 Specification snapshot — the values that do not change 22



A school field years after construction — the profile below it has needed no emitter servicing and no line repairs.

Contents — continued

III How It Works — Installation & Operation

3.1 What principle does the EPIC System work on? 25

3.2 What are the layers of the system, from top to bottom? 26

3.3 Step by step, how does water move through the system? 27

3.4 What are the design rules? 29

3.5 How is an EPIC Cell installed, and what are the four hold points? 30

3.6 What does an EPIC installation look like on site? 31

3.7 How is the system operated and maintained? 32

IV Cradle to Cradle — Sustainability & Recyclability

4.1 What does “Cradle to Cradle” mean for EPIC? 34

4.2 How reusable and recyclable is the system? 34

4.3 What happens to the plastic components at end of life? 35

4.4 What happens to the natural materials? 35

4.5 What is polypropylene, and where does it come from? 36

4.6 Is plastic really bad for the environment here? 37

4.7 Why aren’t the plastic components biodegradable — and why is that good here? 38

4.8 How do EPIC’s applications add value to a project? 38

4.9 What are the highlighted applications and benefits? 39

· Front & Back

– About this guide 2

– EPIC in one page 6

– In summary — one system, total water management 40

– The verified numbers 41



Chambers set out across a lined cell before the aggregate goes in — one basin, one water surface.

IN BRIEF

EPIC in one page

EPIC is a sealed, gravity-driven basin built under the ground. It irrigates from below by capillary rise, drains from above by infiltration, filters what passes through it, and stores what it captures — with no emitters, no spray, no pressure lines and no moving parts inside the growing area.

01 A level, compacted floor is lined with a 45-mil EPDM geomembrane, forming a basin that loses nothing to the ground below.

02 Patented EPIC chambers are set on the liner in rows and joined by 2″ connector pipes to a perimeter header and a feed vault.

03 Gravel is placed around the chambers to spread water evenly across the liner and keep sand out of the chamber openings.

04 Qualified sand is placed over the gravel — the growing medium and the wick that lifts water to the root zone.

05 In irrigation mode water enters the chambers, floods the gravel, and rises through the sand by capillary action into an aerobic root zone. Plants take what they need; nothing evaporates from a surface that is never wetted.

06 In drainage mode the same profile runs in reverse — rain and runoff filter down through the sand, are captured by the chambers, and are stored for reuse or released under control.



The recreation field on the Microsoft Silicon Valley campus — living turf on recycled water over a sealed EPIC profile.

50-85%

LESS IRRIGATION WATER
THAN SURFACE OR DRIP

99.5%

NATURAL MATERIALS BY WEIGHT
UNDER 0.5% PLASTIC

3

U.S. PATENTS
TWO CHAMBER TYPES

0

MOVING PARTS INSIDE
THE GROWING AREA

THE ONE RULE THAT GOVERNS THE REST

Water finds its own level. An EPIC Cell is a sealed basin, so the water surface inside it is dead level whatever the ground above looks like. If the cell floor is out of level, one end sits deep in water and the other sits dry. The tolerance of **±13 mm across the cell floor** is not a preference — it is the operating condition of the system.



Chambers set out across a lined cell before the aggregate goes in — one sealed basin, one water surface.

PART I

The System of Choice

What EPIC is, what it does without being told to, and why a passive, gravity-driven profile outperforms pressurised irrigation in arid ground.

1.1 What is the EPIC Water Management System?

1.2 Why is EPIC the system of choice for sand-culture hydroponics?

1.3 What water-management functions does EPIC provide automatically?

1.4 Why is EPIC environmentally friendly?

1.5 Why is EPIC simple?

1.6 How does EPIC save water?

1.7 Does EPIC have low operational and maintenance costs?

1.8 What are the direct and indirect impacts of EPIC?

1.9 What water can EPIC run on?



Turf established edge to edge over an EPIC profile — every square metre fed from below, with no sprinkler or emitter above grade.

PART I · THE SYSTEM OF CHOICE

What EPIC is

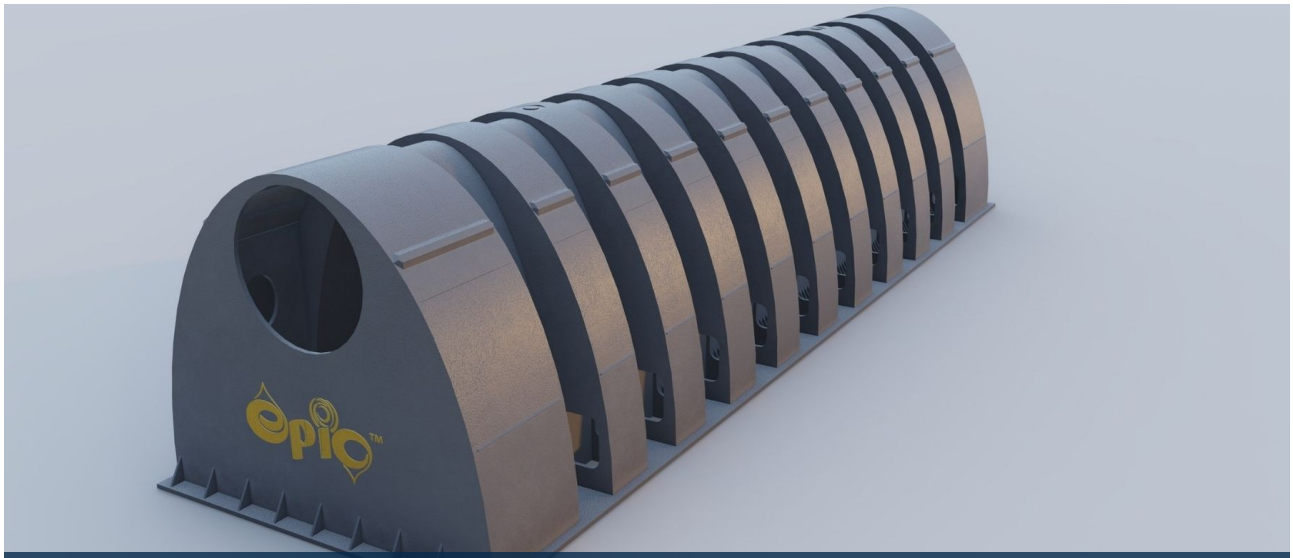
1.1 What is the EPIC Water Management System?

The EPIC Water Management System (EPIC Chamber™) is a subsurface water-management system, fully patented and produced in the United States. Until now very few subsurface systems existed worldwide, and those that did shared two defects: they clogged, and they could not control water levels in the soil. EPIC solves both.

EPIC's patented core technology — the **E**nvironmental **P**assive **I**ntegrated **C**onveyance Chamber — combines highly efficient irrigation and drainage in one package, driven by non-pressurised, gravity-fed capillary physics through washed sand, with a direct interface to the EPIC subsurface pipe that never clogs. No other system like it exists today.

1.2 Why is EPIC the system of choice for sand-culture hydroponics?

The growth medium is sand — no soil. In the Middle East especially, sand is abundant, sterile and ideally suited to the science of capillary rise, making it the best growing medium available. What makes EPIC innovative is the chamber geometry combined with the materials used across the whole solution (chamber, gravel, sand): the chamber is shaped so simply and so strategically that it cannot clog, while the graded sand profile delivers moisture to roots by natural wicking.



The EPIC Chamber — a moulded polypropylene arch with a flanged base, side-wall openings and offset inner apertures.

1.3 What water-management functions does EPIC provide automatically?

The system delivers complete subsurface water management on its own:

- Exceptional non-plugging irrigation **and** drainage in one system.
- Passive, non-pressurised, 100% efficient irrigation — the only water consumed is the plant's evapotranspiration, so there is zero waste.
- In drainage mode the system acts as a sand / bio-filter and captures and retains storm events for reuse (water harvesting) — an exceptional tool in both very wet and very dry climates.

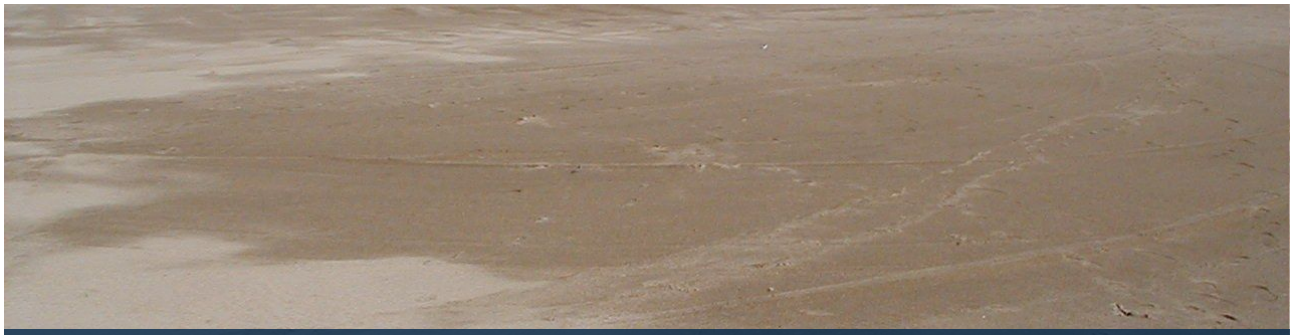
Greywater, brackish water and blackwater can all be used for irrigation without mechanical plugging or public-health concerns, because the water is always kept below the surface — something conventional irrigation cannot do.

1.4 Why is EPIC environmentally friendly?

The bulk of the system is natural, locally available, abundant dune sand. The man-made components are fully reusable and recyclable, and are connected in the field without volatile glues. The underground liner barrier prevents water loss and stops nutrient introduction into groundwater formations. With very few moving parts, EPIC uses very little water — and very little energy to distribute it.

1.5 Why is EPIC simple?

EPIC has no moving parts, needs very little maintenance, and was built to work much like nature itself. A simple rearrangement of openings gives the system three-dimensional control of water flow below ground. Water needs are decided by the plants, not by computer models, and flow follows the natural laws of gravity and capillary physics — not complex pressure lines, control valves or electronics.



Capillary wetting across bare sand before seeding — moisture arrives from below across the whole field, with no pipe, sprinkler or emitter above grade anywhere on site.

1.6 How does EPIC save water?

A subgrade liner ensures no water is lost to the ground below — it is retained entirely within the system. Because water rises by capillary action through the sand, droplets and films are never created above the profile where they would evaporate, as they do in overhead spray, surface drip and flood irrigation. The flat, absorbent sand profile lets rainfall flow into the system rather than running off, for total rain capture.

As a non-pressurised gravity-flow system, EPIC avoids the line breaks and leaks where conventional systems lose substantial water. The plants themselves determine their water needs and use only what they require, eliminating the overestimation and waste of conventional practice — for example, watering the whole soil profile for a small plant whose roots cannot yet reach it. Total recirculation retains water in the profile until it is used.



The large EPIC chamber — 46 inches of moulded polypropylene, and the component the whole profile is built around.

1.7 Does EPIC have low operational and maintenance costs?

Yes — for several reasons:

- Durable, passive components sit beneath the sand profile, so there are no parts to wear out, plug or break within the growing area — nothing needs replacing for the design life of the profile.
- In irrigation applications the system can run on solar energy in remote areas, with solar-powered pumps covering the full pump-operation load.
- Water transmission uses very little energy — the system moves water chamber-to-chamber with no parts except a single pump.
- With no moving parts to service, minimal staff are needed — no hunting for plugged emitters, broken components or split delivery lines. Using dune sand as the profile also removes seasonal ploughing and rotovating.
- A single low-cost 110 V recirculation pump can irrigate an area as large as 10,000 m^2; smaller areas use even smaller pumps. This pump is the only moving part that may require maintenance.
- There are no surface components that can be damaged intentionally or accidentally.



The University of Nevada, Reno field in 2022 — still in service more than two decades after the profile was built.

1.8 What are the direct and indirect impacts of EPIC?

- By conserving 50–85% of water consumption, more water becomes available for use — effective supply inherently increases.
- As less water is used, the infrastructure needed to deliver it can be minimised.
- Used as a bio-filtration tool, the system allows reuse of water that would otherwise be discarded.
- It can be installed in remote areas and rely on solar energy for water harvesting, transmission and irrigation.
- Water transmission uses very little energy — chamber-to-chamber pumping needs only one pump.
- For rainwater harvesting, EPIC can be installed almost anywhere to capture water for transmission and use on site.
- Confirmed water reduction, passive non-pressurised flow, and reuse of locally produced wastewaters all translate into fewer and smaller distribution lines.



An EPIC-irrigated planting bed in an arid setting — flowering growth sustained entirely from below grade.

1.9 What water can EPIC run on?

Because water in an EPIC Profile never touches air, leaf or human contact at the surface, the system can run on waters that surface irrigation cannot responsibly use. The EPIC record includes an installation for each rung of the water-quality ladder.

WATER CLASS	HOW EPIC USES IT
Potable / fresh	The baseline case — metered at municipal and campus scale, against conventional sprinkler control.
Treated sewage effluent (TSE)	Delivered entirely below grade, so there is no aerosol, no surface contact and no restricted irrigation window. The Gulf's principal future landscape water.
Greywater	Plumbed directly into a planted cell as a subsurface resource; being fully subsurface mitigates the health concerns that limit surface greywater reuse.
Blackwater / septic effluent	Handled as alternating leach fields on a diverter valve — one field working while the other rests. The large chamber is the preferred unit here.
Brackish & desalination reject	Run as a metered charge with the cell flushed through its low-point drain fitting, so salt moves through the profile instead of accumulating in it.
Saline & seawater	Surge-fed coastal cells at 160 mm surge depth and 4 L/min per chamber, supporting salt-tolerant vegetation on 100% seawater.

> **SALT IS MANAGED, NOT ACCUMULATED**
>
> Salinity is handled by design, not by hope. The charge is metered, the cell is flushed through its controlled low-point drain, and the sealed basin keeps the salt front inside the profile and out of the surrounding ground. Fifteen months of monitored operation on blended desalination reject at 6,000–7,000 ppm TDS ran consistently; parallel Abu Dhabi trial plots on 100% seawater recorded no salinity accumulation and no contamination of adjacent soils.

PART II

System Components Explained

The two families of components, the moulded chamber at the centre of them, and the fixed values a specifier can rely on.

2.1 How many types of EPIC chamber are there, and what are the patents?
2.2 What two families of components make up the system?
2.3 What is the EPIC Chamber?
2.4 What liner is used?
2.5 What role does the gravel play?
2.6 What role does the sand play?
2.7 What else is inside an EPIC Cell?
2.8 Chamber specifications at a glance
2.9 Specification snapshot — the values that do not change



EPIC chambers set out before burial — the moulded arch that stores and conveys water beneath the profile.

PART II · SYSTEM COMPONENTS EXPLAINED

What the system is made of

2.1 How many types of EPIC chamber are there, and what are the patents?

There are two chamber types, protected by three patents:

- **Large Chamber** — U.S. Patent 5,921,711 (and 7,517,172 for the modified large chamber).
- **Small Chamber** — U.S. Patent 10,472,813.

In summary: the **small chamber** is the mainstream unit used for all applications, while the **large chamber** is preferred for blackwater and leach-field applications.

2.2 What two families of components make up the system?

Sustainable design and a living system combine to form the EPIC water-management system, composed of two families of components:

- **Plastic components:** EPIC chambers, 2″ connector pipes, and the geomembrane (waterproof) liner.
- **Natural materials:** water, sand, gravel and natural vegetation (living matter).

On average by weight the system is less than 0.5% plastic components and 99.5% natural materials. The plastic components control the fluid dynamics; the natural materials perform the environmental service. Living systems of vegetation and microorganisms clean and reuse water through physical uptake and biological breakdown of pollutants. The two families work in synergy for the system to function.



The two EPIC chambers — small (left) and large (right).

2.3 What is the EPIC Chamber?

Made of solid recycled resin, the Environmental Passive Integrated Conveyance chamber is the centrepiece of the system — durable and non-biodegradable, it is the integral water storage and transfer area. Its patented, innovative design prevents clogging, controls the water level, and stores water for stormwater management and rainwater harvesting. The chamber is currently manufactured in the United States, with regional production planned to cut costs and improve availability.

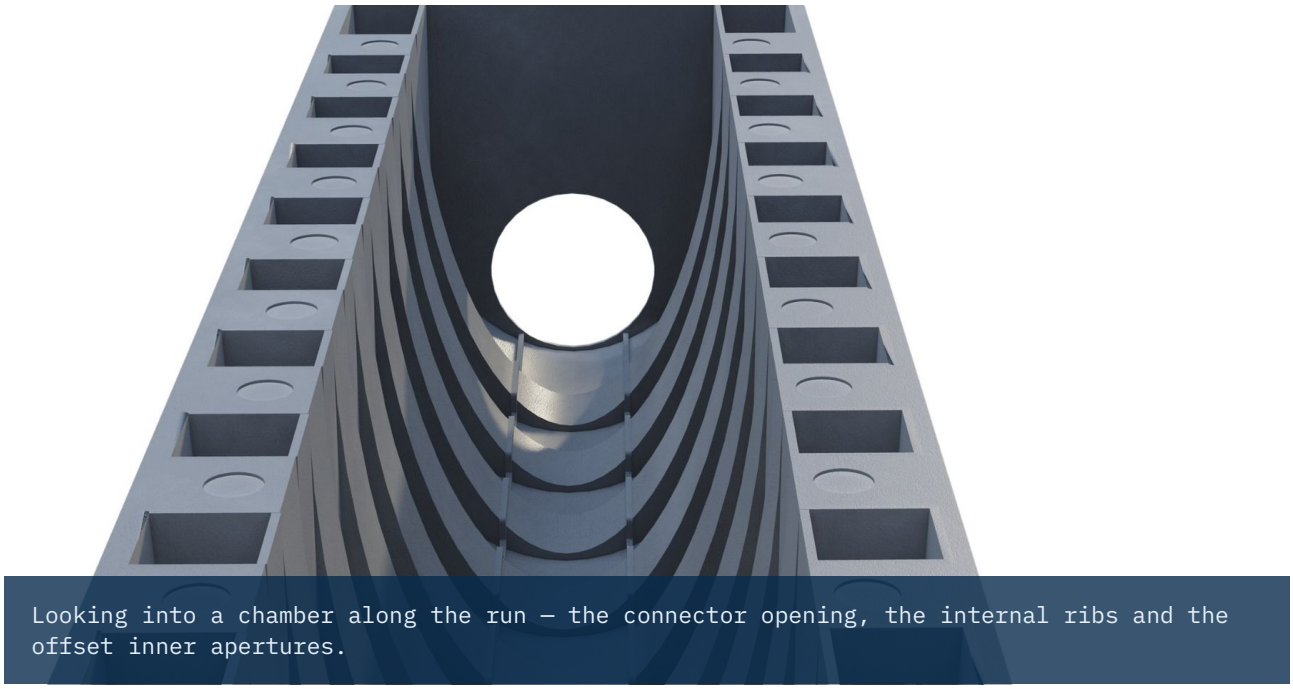
Three features do the work. The **side-wall openings** along the skirt let water pass between the chamber and the gravel bed in both directions. The **offset inner apertures** sit on a different plane, so no straight path exists for migrating sand to follow — the reason the chamber does not plug. The **open bottom** seats directly on the liner, so the chamber and the basin share one water surface, and the flanged base pad spreads the load of the profile above.



Outside the wall — the side-wall openings along the skirt, where water passes between the chamber and the gravel bed in both directions.



Inside the same chamber — the offset inner apertures sit on a different plane, so migrating sand never finds a straight path through the wall.



Looking into a chamber along the run — the connector opening, the internal ribs and the offset inner apertures.

2.4 What liner is used?

A 45-mil (1.14 mm) EPDM liner forms the bed that holds water and prevents it from seeping to lower soil levels. The specified EPDM geomembrane is a single-ply synthetic-rubber waterproofing membrane (ethylene-propylene-diene monomer blended with carbon black, oils, curing agents and processing aids), calendered into large sheets and vulcanised. While other liners exist, this EPDM is the liner of choice for its durability, ease of installation and manufacturing quality — backed by a 20-year manufacturer warranty that reflects the maker's confidence in the product.

Two life figures travel with an EPIC specification, and they measure different things: the liner carries a **20-year manufacturer warranty**, while the system as a whole is built for a **service life of 50 years or more**, because nothing inside the profile wears, pressurises or degrades under UV (see 4.7).

2.5 What role does the gravel play?

Gravel is laid on the liner outside the chamber, to just above the outer drain hole — nominally 50–80 mm depending on chamber type and design. It distributes water evenly across the EPDM liner and prevents sand from clogging the chamber's drain holes. Grain size depends on the sand used on the project: a specific sand-to-gravel ratio must be maintained so the sand does not migrate down into the gravel. For non-vegetative applications, gravel is used through the entire profile depth to give fast infiltration and unrestricted airflow.



The lined basin formed and levelled before any chamber is set — the liner is a basin with upturned sides, not a sheet laid flat.

2.6 What role does the sand play?

Sand is spread over the gravel and chamber. It is the medium through which water moves upward by capillary rise to reach plant roots. The type of sand depends on the project location: medium-grain sands are generally most desirable, but finer sands — such as locally available dune sand — are also permissible in the EPIC profile. All sand must be tested for capillary rise and permeability; the results determine its suitability and the depth needed to achieve proper capillary rise and sufficient space for the oxygen transfer plants require.

2.7 What else is inside an EPIC Cell?

Beyond the chambers, liner, gravel and sand, a working cell contains a short, deliberately ordinary list of parts — all of it standard, specifiable plumbing:

- **Connector pipes** — 2″ (50 mm) Schedule-40, joining chamber to chamber along the row and back to the header.
- **Supply and drain headers** — typically 6″ (150 mm) PVC, solvent-welded, run around the field perimeter.
- **Supply vault and float station** — where water enters the cell and the level is set; no timers and no electronics are required for the level control itself.
- **Zero-drain outlet** — the controlled low-point fitting used to flush a cell and, on saline and reject-water systems, to manage salt.
- **One pump** — the single moving part in the installation, sized to the cell and capable of running on solar in remote locations.



Qualified sand being placed over the installed chambers and liner — the growing medium and the wick, going in as the last layer of the cell.

2.8 Chamber specifications at a glance

PROPERTY	LARGE CHAMBER	SMALL CHAMBER
Size	46″ L × 13.25″ W × 6.5″ H	24″ L × 6.5″ W × 5.5″ H
Colour	Black	Black or custom
Weight	5.5 lb (2.49 kg)	1.7 lb (0.77 kg)
Polymer	Polypropylene	Polypropylene
Connection opening	2.375″ (nominal 2″ Sch40 pipe)	2.375″ (nominal 2″ Sch40 pipe)
Side-wall openings	46 — 0.75″ × 1.30″ (44.85 in²)	40 — 0.75″ × 0.75″ (22.5 in²)
Offset inner apertures	46 — 0.875″ circles (27.66 in²)	22 — 1″ × 1.5″ ovals (25.92 in²)
Open-bottom area	45.5″ × 10.25″ (466 in²)	23.5″ × 3.375″ (79.31 in²)
Total internal volume	9.67 gal (1.29 ft³)	2.08 gal (0.28 ft³)
Volume at connection invert	6.02 gal (0.80 ft³)	1.4 gal (0.19 ft³)
Connector stop distance	3.25″ (to nub)	2″ (to arch)
Base-pad support area	69.5 in²	30 in²
Packaging	30 / pallet (166 lb)	16 / box (28 lb); 8–12 boxes / pallet



Sand placement over a lined and chambered cell at Al Salamat Park, Al Ain.

READING THE TABLE

The two aperture rows are the non-clogging geometry: side-wall openings and offset inner apertures sit on different planes, so migrating sand has no straight path through the wall. The two volume rows matter for storage design — total internal volume is the chamber full; volume at connection invert is what it holds before water reaches the connector and moves on down the run.



A transparency render set among production chambers, showing the internal arch and aperture pattern.

2.9 Specification snapshot — the values that do not change

These are the fixed values behind an EPIC design. They travel with the specification and are the first things a reviewing engineer should look for.

PARAMETER	VALUE
Field-cell excavation depth	600 mm (24 in)
Tree-cell dimensions	140 × 140 × 60 cm, one chamber per cell
Chamber row spacing	2.0 m centres
Chamber spacing along row	0.9 m centres
Chamber-to-header connector	2 in (50 mm) × 1,025 mm
Field perimeter header	6 in (150 mm) PVC, solvent-welded
Design standing-water depth	75 mm (3 in)
Subgrade tolerance	±13 mm across the cell floor (instrument survey)
Liner	45-mil (1.14 mm) EPDM, field-seamed, full side upturns
Coastal / seawater cell	160 mm surge depth · 4 L/min per chamber
Golf / bunker drainage density	1 chamber per 300 sq ft (27.9 m²) + 2 in solid PVC
Road-filter fill depth	16–24 in (400–600 mm), ASTM sieve-specified
Wastewater sizing basis	285 L (75 gal) per person per day
Clearance above groundwater	0.6 m (2 ft), wastewater systems



A moulded chamber fitting with connector sockets — the standard interface between chamber, pipework and vault.

WHAT EPIC IS NOT

It is not a pressurised system, so it has no operating pressure to specify and no pressure-loss calculation to run. It is not a drip or emitter system, so there is no emitter schedule, no flushing manifold and no filtration head loss. It is not a soil-based system — the medium is qualified sand, and sand qualification is a submittal, not an assumption.



EPDM liner, chambers and header pipe on site at Al Salamat Park, Al Ain — the specification as built.

PART III

How It Works — Installation & Operation

The physics, the layer stack, the path a droplet takes, the design rules that govern the build, and the four hold points that protect it.

3.1 What principle does the EPIC System work on?

3.2 What are the layers of the system, from top to bottom?

3.3 Step by step, how does water move through the system?

3.4 What are the design rules?

3.5 How is an EPIC Cell installed, and what are the four hold points?

3.6 What does an EPIC installation look like on site?

3.7 How is the system operated and maintained?



Aggregate placed by telebelt over a lined and chambered cell — the sequence that turns four simple elements into a working profile.

PART III · HOW IT WORKS

The physics and the profile

3.1 What principle does the EPIC System work on?

The EPIC System uses the properties of capillary attraction to provide subsurface irrigation and drainage in one package. It consumes 50–85% less water than traditional surface or drip irrigation. Any stormwater surge or runoff is retained and held for reuse or released slowly in a controlled manner. Incorporated into sustainable designs, EPIC significantly reduces — and can eliminate — the need for a fresh-water source in irrigation. University trials record better turf quality alongside the water saving, not in spite of it — the measured figures are set out in 4.9 and in the verified numbers at the back of this guide.



EPIC pipework laid in trench before backfill — the connection between cell, header and reservoir.

3.2 What are the layers of the system, from top to bottom?

- **1. Landscape layer** — a non-pressurised, passive subsurface irrigation, drainage, water-collection and filtration system installable in any landscape area for fully efficient irrigation and total stormwater management.
- **2. Sand layer (≈ 50 cm)** — below the vegetation, porous sand supports exceptional root growth and filters and collects runoff from adjoining hard surfaces.
- **3. Gravel layer (≈ 5–8 cm)** — below the sand, a thin layer of fine gravel spreads water quickly and evenly across the EPDM.
- **4. Liner layer** — on top of the waterproof liner, a network of EPIC chambers collects and distributes water evenly and without plugging. Holes near the bottom of each chamber let water flow out and spread across the liner; in excess-water conditions the flow reverses, moving from the liner into the chambers and on to a discharge line. The hole design and the gravel layer keep the openings from clogging.



The EPIC profile in a streetscape, drawn as separated layers — planting, sand, gravel, chambers on the liner, and subgrade.

3.3 Step by step, how does water move through the system?

DRAINAGE MODE — FROM THE SURFACE DOWN

01 When rain or surface runoff meets the system, the sand profile immediately begins filtration as water moves downward through the sand.

02 The water moves into the fine gravel, is prevented from leaching out by the EPDM liner, and then enters the chamber through the gravity trap.

03 It fills the chamber and exits via the connector pipe.

04 The chambers and connector pipes distribute water evenly throughout the system and retain a portion for irrigation reuse; excess transfers to a secondary below-ground reservoir or is filtered and cooled to a designated discharge point.

IRRIGATION MODE — FROM THE CHAMBER UP

01 Water is introduced into the chamber, which transfers it into the gravel and then the sand profile.

02 Water moves upward from the gravel by capillary action, forming an aerobic, evenly dispersed moisture profile in the root zone for plants to grow in.

03 This highly aerobic zone is exceptional for root growth and simultaneously acts as a bio-filter — providing drainage, irrigation, rainwater harvesting and bio-filtration in one package. Plants always have water available and determine how much they take up.



Cross-section of an EPIC cell: water drains down through the sand to the chamber, then wicks upward by capillary action into the aerated root zone.



Drainage mode — rainfall filters down through sand and gravel and is captured by the chambers on the liner.



Irrigation mode — water wicks upward from the chambers by capillary action to feed the root zone.



Dune sand and EPIC hardware on site — sand and gravel are the system's primary components by weight.

3.4 What are the design rules?

An EPIC design is governed by a short set of rules. They are not preferences; each one exists because the physics stops working without it.

- **The floor must be level.** A sealed basin has one water surface. Grade and compact the cell floor to ±13 mm and verify it by instrument survey. On sloping sites, form stepped, level benches — water spreads only on a level floor.
- **Cut to formation, do not backfill loose.** 600 mm for a field cell, 60 cm for a tree cell. Over-digging and re-filling destroys the plane the survey just proved.
- **The liner is a basin, not a sheet.** Side upturns to design water level plus freeboard; no sharp stone beneath it; a grommet or boot at every penetration.
- **Set the geometry, not just the count.** Rows at 2.0 m, chambers at 0.9 m along the row — or one chamber per tree cell.
- **Qualify the sand before you order it.** Capillary rise and permeability results determine both suitability and the depth required. The sand-to-gravel ratio must prevent migration.
- **Design the standing water depth.** 75 mm is the working figure for field cells; coastal and saline cells are surge-fed at 160 mm.



Chamber rows seated on the liner and connected back to the perimeter header — the geometry of 2.0 m rows and 0.9 m spacing, as built.

3.5 How is an EPIC Cell installed, and what are the four hold points?

The build sequence is short and repeatable. Four hold points protect the specification and the warranty; each is signed before the next stage begins.

01 **Set out and excavate** — cut to formation at 600 mm, keeping the floor plane and removing sharp stone that could point-load the liner.

02 **Level the subgrade — HOLD POINT HP-1.** Compact and grade to ±13 mm, verified by transit or laser, with every corner and transition elevation recorded on the as-built survey.

03 **Place the liner** — EPDM panels laid into the cell with full side upturns; installed liner protected from all traffic.

04 **Seam and seal — HOLD POINT HP-2.** Field-seam and roll all panels per the membrane manufacturer's system; grommet or boot every penetration; inspect and sign the sealed basin before anything is placed on it.

05 **Set chambers** — rows at 2.0 m, chambers at 0.9 m, seated directly on the liner and ballasted against flotation during sand placement.

06 **Connect pipework** — 2″ Sch-40 mains and laterals, solvent-welded, with inlets and zero-drain outlets connected to the header and vault.

07 **Place gravel, then sand — HOLD POINT HP-3.** Media qualification records are submitted and approved before placement; unqualified media is rejected.

08 **Charge and commission — HOLD POINT HP-4.** Water is charged to protocol and the charging record submitted at handover, with the cell proven level under water.



From land preparation to laying, securing and seaming the EPDM liner, then installing the chambers and connecting the header and vault pipes.

3.6 What does an EPIC installation look like on site?

The sequence below shows a real EPIC installation from land preparation through liner, chambers, gravel, sand and planting — to established landscape and crops weeks later.



Reservoir and pump, gravel layer, sand layer, and the completed subsurface set-up — with desert ground transformed into thriving crops weeks after planting.



Salt-tolerant rows on the Abu Dhabi trial plots — planting established in open dune sand on seawater.

3.7 How is the system operated and maintained?

Operation is a level and a schedule, not a control system. Water is charged to the design standing depth through the supply vault; the float station holds it there. Where the design requires it, cells are flushed through the zero-drain outlets — the same fitting that manages salt on saline and reject-water systems. On wastewater systems, the alternating leach fields are switched on their yearly turn. The pump and any control equipment are serviced per their own schedules.

The structure itself has no service schedule. There are no emitters to flush, no lines to purge and no surface hardware to repair, so maintenance is inspection rather than intervention.

FERTIGATION WITHOUT EMITTERS

EPIC feeds as well as it waters. Liquid or water-soluble fertiliser is added to the source tank or reservoir, and the sealed profile distributes it with the water to the whole cell. There is no injector, venturi or dosing controller — and that is precisely why it works, because there is nothing a nutrient solution can foul. Against drip fertigation there are no emitters to clog with fertiliser salts or biofilm, no leaf burn, no spray window, no surface salt ring, and no wind or evaporation loss; distribution is uniform across the run. A Gulf greenhouse recorded 40% less fertiliser alongside 81% less water.



Established turf over an EPIC profile at Al Salamat Park, Al Ain — nothing above grade to service, adjust or replace.

PART IV

Cradle to Cradle — Sustainability & Recyclability

Materials science, end-of-life, and the return a long-lived circular water system delivers across a project's lifespan.

4.1 What does “Cradle to Cradle” mean for EPIC?

4.2 How reusable and recyclable is the system?

4.3 What happens to the plastic components at end of life?

4.4 What happens to the natural materials?

4.5 What is polypropylene, and where does it come from?

4.6 Is plastic really bad for the environment here?

4.7 Why aren’t the plastic components biodegradable — and why is that good here?

4.8 How do EPIC’s applications add value to a project?

4.9 What are the highlighted applications and benefits?



EPIC growth capabilities across water sources — landscape on TSE, fields on greywater, halophytes on seawater.

PART IV · CRADLE TO CRADLE

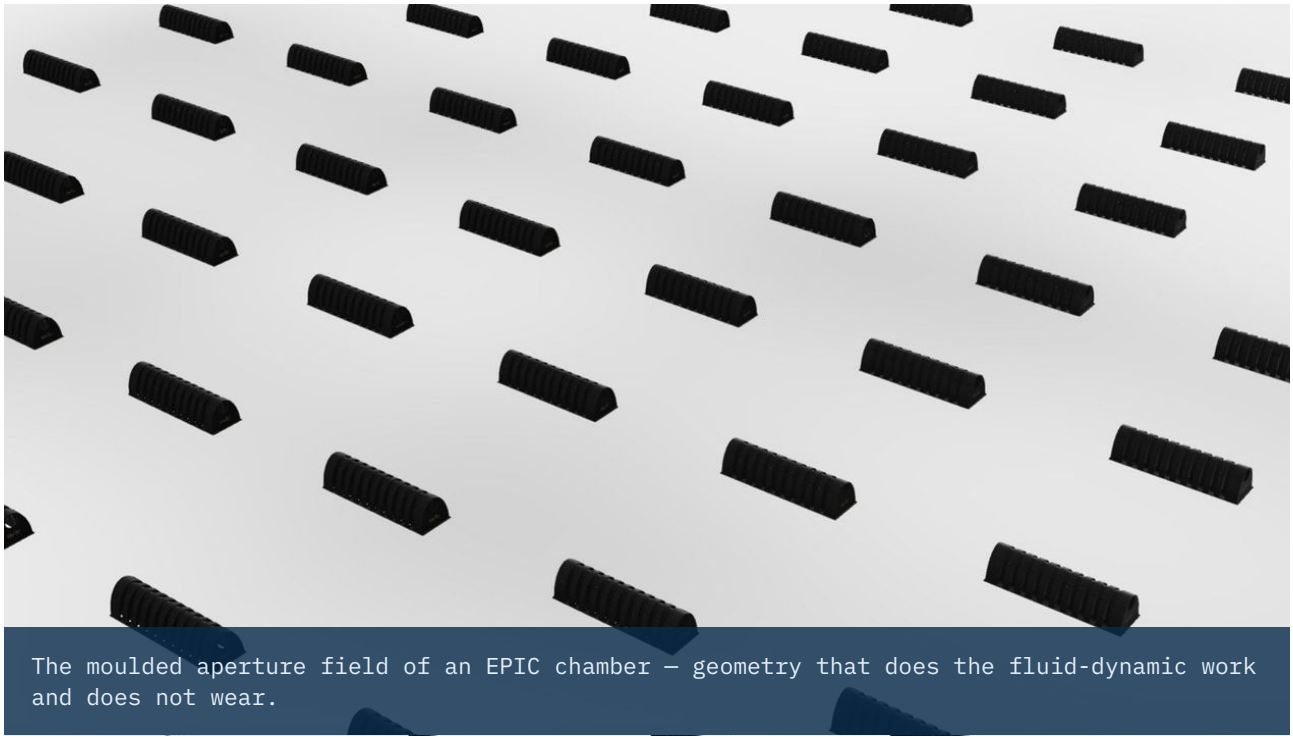
Materials, end of life and return

4.1 What does “Cradle to Cradle” mean for EPIC?

The EPIC chamber is a non-clogging drainage and irrigation device that uses natural passive processes to manage and direct water. Water is physically filtered by aggregate, naturally cooled by geothermal effect, and detained in the void space within the aggregate profile, while living systems of vegetation and microorganisms clean and reuse water through physical uptake and biological breakdown of pollutants. The system is composed of two families of compounds — plastic components (chambers, 2″ connector pipes, liner) and natural materials (water, sand, gravel, vegetation) — which by weight average under 0.5% plastic and 99.5% natural. The plastic controls the fluid dynamics; the natural materials perform the environmental service; the two must work in synergy.

4.2 How reusable and recyclable is the system?

EPIC attains the ultimate goal of recycling: the products are totally reusable with no intermediary process. By design the components are not glued, are non-pressurised, and are protected from UV degradation, so they are completely reusable — EPIC TWS has relocated complete designs (plastic and natural components) more than ten years old to be reused in another location.



The moulded aperture field of an EPIC chamber — geometry that does the fluid-dynamic work and does not wear.

4.3 What happens to the plastic components at end of life?

The plastic components can be extracted and reused directly, or shredded and ground for traditional plastic recycling. It is worth noting that the whole-system energy and labour equation of any recycling process is rarely analysed: efficient recycling produces a net environmental gain, while some recycling loses more energy than it saves.

4.4 What happens to the natural materials?

The natural components are the living systems that provide water treatment, retention and improved irrigation efficiency. The primary component by weight — sand and gravel — is always sourced locally, and on recycling can be reused as fill, grading material or other aggregate. Surface vegetation and roots are compostable by traditional methods. In irrigation, EPIC uses 50–85% less water than traditional sprinkler systems; in treatment, the natural components remove over 90% of total suspended solids, 85% of total phosphorus and over 60% of nitrates (Rice Creek Watershed District research — see 4.9).

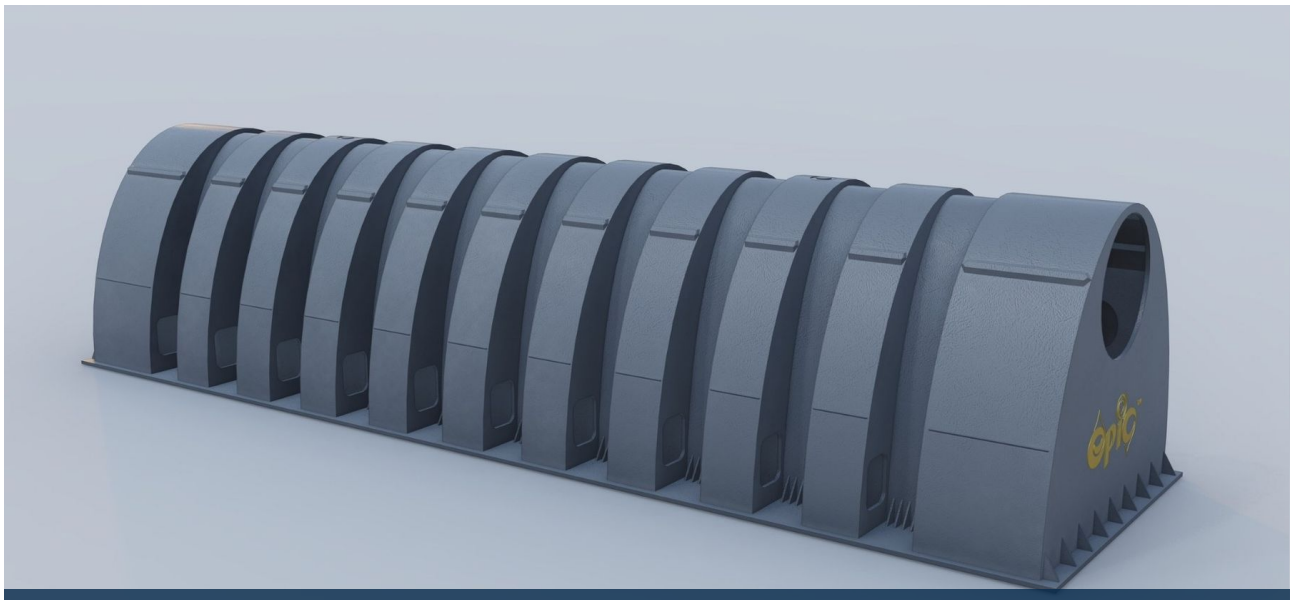


Seed germinating across a sand profile fed only from below — the living half of the system doing the environmental work.

4.5 What is polypropylene, and where does it come from?

Polypropylene is the primary chemical component of EPIC chambers and pans — essentially a polymer of carbon and hydrogen, and a common plastic used in everything from baby toys and bottles to car fenders and frisbees. It is the 10th-largest-volume chemical used in the United States, derived from the third-largest — ethylene gas — which in turn comes from natural gases associated with fossil-fuel-bearing geologic formations.

COMPONENT (FORMULA)	TYPICAL MOL %
Methane (CH_4)	70 – 90 %
Ethane (C_2H_6)	4 – 10 %
Propane (C_3H_8)	1 – 5 %
Butanes and higher (C_4H_{10}+)	0 – 2 %
Carbon dioxide (CO_2)	0 – 8 %
Nitrogen (N_2)	0 – 5 %
Hydrogen sulphide (H_2S)	0 – 5 %
Oxygen (O_2)	≤ 0.2 %
Water vapour (H_2O)	Variable



The EPIC chamber seen from the end — the arch, the flanged base pad and the aperture rows that keep it from plugging.

4.6 Is plastic really bad for the environment here?

The accidental association of plastics — polypropylene specifically — with oil byproducts has led environmentalists to label the material a pollutant, but that is not necessarily the case. Before the plastics industry was born in the 1950s, natural-gas emissions from oil wells were simply bled to the atmosphere or flared as waste — a practice still common on many international oil wells — oxidising the gas into carbon dioxide and water vapour. Chemistry converted this oxidising "waste product" into usable, stable, non-biodegradable polymers.

As for plastic's carbon footprint: converting ethylene to plastic interrupts the oxidation cycle and locks carbon up ("sequesters" it) in solid form, preventing that carbon from becoming atmospheric CO_2. Plastics thus became, unintentionally, sequestration "sinks" for the carbon waste of oil wells — technically retarding the addition of CO_2 to the atmosphere.



The EPIC chamber in profile — polypropylene moulded to hold its form underground for decades.

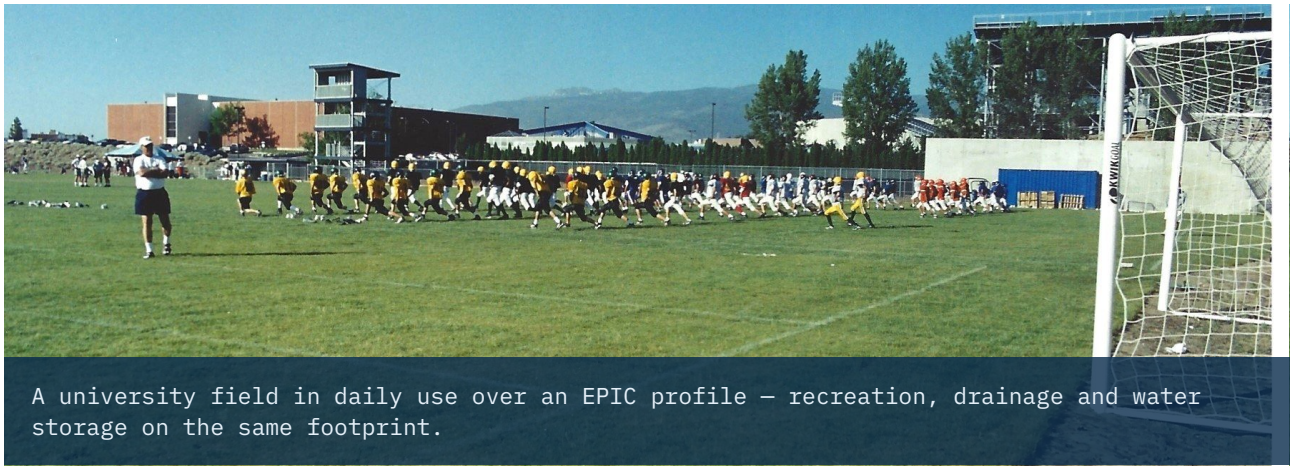
4.7 Why aren’t the plastic components biodegradable — and why is that good here?

“Biodegradable” has risen in the sustainability lexicon as an automatically desirable trait, but the full picture is often obscured by a misunderstanding of materials and their intended uses. Biodegradability of organic products is a good thing — otherwise we would be buried in rubbish — and EPIC uses that very process to break down organic matter for reuse by plants and microorganisms in its living systems.

But EPIC's plastic components have a functional reason **not** to biodegrade. They could be made from biodegradable materials at far greater cost, but those would rot and collapse underground. Because the plastic does not break down, it extends system longevity: the system functions for over 50 years, and the plastics keep their form for hundreds. If a system does eventually fail through solids buildup, the plastic can be extracted and reused — saving the energy of producing new material.

4.8 How do EPIC’s applications add value to a project?

A holistic approach is the backbone of every EPIC TWS design. Suitability depends on the overall water-management design — fresh water, greywater, stormwater, saline and blackwater can all be drivers, as can land-use factors such as land cost, leasable area, parking capacity, grey-infrastructure cost and landscape performance. As isolated pieces the solutions may not be the obvious economic choice, but used in concert with proper grading, seasonal land uses, water demand and quality, impervious surfaces, parking mandates, greywater reuse, stormwater management and landscape design, EPIC TWS has not completed a project without positive economic and environmental returns — delivering higher project density, richer landscape design, more parking capacity, better water quality, and long-term returns from landscape multifunctionality.



A university field in daily use over an EPIC profile — recreation, drainage and water storage on the same footprint.

4.9 What are the highlighted applications and benefits?

- **Irrigation efficiency** — subsurface irrigation uses 50–85% less water than traditional overhead systems. In the New Mexico State University trials (Dr Bernhard Leinauer), greens on subsurface irrigation used 50–70% less water with better turf quality than the standard USGA profile; the report's own metered figures are −40% gross and −41% net.
- **Stormwater quality treatment** — a 2007 Rice Creek Watershed District (Blaine, MN) study of a perimeter EPIC system captured, filtered and stored site runoff, indicating: total-phosphorus reduction 85%; suspended-solids reduction over 90%; pathogen reduction up to 35% (coliform, streptococci, E. coli); and significant removal of trace metals, pathogens and toxins.
- **Multifunctional landscapes** — parks, fields and open spaces can serve recreation, stormwater management/treatment, and events/parking at the same time while maintaining water quality.
- **Decreased grey infrastructure** — fewer impervious surfaces mean less stormwater pipe, fewer catch basins, and lower curb costs.
- **Stormwater reuse** — drawing on storage for irrigation significantly reduces municipal-water demand (about 60% of residential water goes to irrigation).
- **Greywater utilisation** — greywater can feed vegetated areas as a subsurface resource; being fully subsurface mitigates health concerns.
- **LEED® credits** — the system can contribute to 33+ LEED credits.
- **Enhanced site design** — optimised runoff treatment, water performance, and storage free space for larger buildings or more open space.
- **Park-like green roofs** — an intensive but comparatively light profile (60–80 lb/ft^2 saturated) supports usable turf or landscape on the roof.
- **Green marketing** — green solutions at the core of a project can raise absorption rates and open new opportunities.
- **Green education** — the infrastructure supports sustainable curricula and positions a campus as a community steward.

IN SUMMARY

One system – total water management

EPIC merges irrigation, drainage, stormwater capture and bio-filtration into one passive, gravity-driven package built on capillary physics and durable polymer chambers. It cuts irrigation water by 50–85%, treats and reuses stormwater and greywater, needs minimal energy and maintenance, and is designed — from cradle to cradle — to be reused and recycled at end of life.

The result is a circular water solution that adds density, landscape value and long-term return to any project. Fitting it to a specific site requires investigation and interaction with the designers, developers and the appropriate government agencies — which is where a project conversation should start.



A school field over an EPIC profile — recreation, drainage and water storage on one footprint.

THE VERIFIED NUMBERS

PARAMETER	VALUE	SOURCE
Metered potable saving, athletic use	55–64%	ECS field statistics, University of Nevada Reno, 2000
Metered saving vs municipal surface irrigation, >50 °C	>76%	Loughland letter, Abu Dhabi, 2007
Seawater operation	100% seawater, no salinity accumulation	Loughland letter
Water saving vs sprinkler; turf quality	−40% gross / −41% net · quality 8.1 vs ≤6.9	Leinauer & Makk, New Mexico State University
Recycled-water saving	+50% saving with hydro-seed germination	Microsoft Silicon Valley client-team record
Runoff reduction · phosphorus removal	−56% runoff · −85% total phosphorus	Wildwood Commons, 2007 (monitored)
Blended desalination-reject operation	6,000–7,000 ppm TDS, 15 months, consistent	Gulf pilot, university-monitored
Surface temperature vs artificial turf	66.5 °F vs 108 °F (−23 °C)	Field note, August 2000
Supply demand, 200,000 sq ft	Single 1-in line, 0–20 gpm, six float stations, no electronics	ECS field statistics, UNR



Salt-tolerant planting on the Yas Island trial plots, Abu Dhabi — vegetation established in open dune sand on seawater.

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Al Salamat Park, Al Ain — a pitch held green on an EPIC profile, with bare ground on the same site beyond the fence.